Amendments to the Claims

The following Listing of Claims replaces all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (currently amended): An error diffusion halftoning method comprising operating a processor to perform operations comprising:

modifying a current input to produce a modified input, wherein the modifying comprises incorporating past quantization errors into the current input;

quantizing the modified input to produce an output; and

processing the output through a data processing path having a bandpass transfer characteristic, wherein the processing comprises deriving an error value from the modified input and the output and diffusing the error value into future inputs.

Claim 2 (previously presented): The method of claim 1, wherein the processing comprises shaping quantization noise in the output in accordance with the bandpass transfer characteristic.

Claim 3 (previously presented): The method of claim 1, wherein the bandpass transfer characteristic has a response that corresponds to a bandpass transfer function B(z) defined by

$$B(z) = \frac{(1-\alpha)H(z) + \alpha H(z)K(z)}{1 - \alpha H(z) + \alpha H(z)K(z)}$$

where H(z) and K(z) are transfer functions~~;~~, and α is a scalar that controls pixel clustering.

Claim 4 (previously presented): The method of claim 3, wherein coefficients of the transfer functions H(z) and K(z) sum to unity at dc, and the bandpass transfer function has a mean-preserving behavior.

Claim 5 (previously presented): The method of claim 1, wherein the processing comprises low-pass filtering the output with a first linear weighting filter, generating a second error value based on the filtered output and the modified input, and low pass filtering the second error value with a second linear weighting filter to produce the first error value.

Claim 6 (previously presented): The method of claim 1, wherein the processing comprises bandpass filtering the error value into future inputs.

Claim 7 (currently amended): Apparatus for performing error diffusion halftoning, the apparatus comprising:

a tangible memory storing instructions; and

a processor coupled to the memory, operable to execute the instructions, and based at least in part on the execution of the instructions operable to perform operations comprising

~~a modifier operable to modify~~ modifying a current input to produce a modified input, wherein the modifier is operable to incorporate past quantization errors into the current input;

~~a quantizer operable to quantize~~quantizing the modified input and to produce an output; and

processing the output through a processing path having a bandpass transfer characteristic, wherein in the processing the processor performs operations comprising deriving ~~and being operable to derive~~ an error value from the modified input and the output and ~~to diffuse~~diffusing the error value into future inputs.

Claim 8 (previously presented): The apparatus of claim 7, wherein the bandpass transfer characteristic has a response that corresponds to a bandpass transfer function B(z) defined by

$$B(z) = \frac{(1-\alpha)H(z) + \alpha H(z)K(z)}{1 - \alpha H(z) + \alpha H(z)K(z)}$$

where H(z) and K(z) are transfer functions, and α is a scalar that controls pixel clustering.

Claim 9 (previously presented): Apparatus for performing error diffusion halftoning, the apparatus comprising a processor operable to perform operations comprising:

modifying a current input to produce a modified input, wherein the modifying comprises incorporating past quantization errors into the current input;

quantizing the modified input to produce an output; and

processing the output through a data processing path having a bandpass transfer characteristic, wherein the processing comprises deriving an error value from the modified input and the output and diffusing the error value into future inputs.

Claim 10 (previously presented): The apparatus of claim 9, wherein the bandpass transfer characteristic has a response that corresponds to a bandpass transfer function B(z) defined by

$$B(z) = \frac{(1-\alpha)H(z) + \alpha H(z)K(z)}{1 - \alpha H(z) + \alpha H(z)K(z)}$$

where H(z) and K(z) are transfer functions, and where α is a scalar that controls pixel clustering.

Claim 11 (previously presented): The apparatus of claim 10, wherein coefficients of the transfer functions H(z) and K(z) sum to unity at dc, and the bandpass transfer function has a mean-preserving behavior.

Claim 12 (currently amended): The apparatus of claim 9, wherein the processor is operable to perform~~ing~~ operations comprising low-pass filtering the output with a first linear weighting filter, generating a second error value based on the filtered output value and the modified input~~;~~, and low-pass filtering the second error value with a second linear weighting filter to produce the first error value.

Claim 13 (previously presented): The apparatus of claim 9, wherein the processor is operable to bandpass filter the error value into future inputs.

Claim 14 (previously presented): The apparatus of claim 9, wherein in the processing operation the processor is operable to shape quantization noise in the output in accordance with the bandpass transfer characteristic.

Claim 15 (currently amended): ~~An article for a processor, the article comprising memory~~A machine-readable memory storing processor-readable instructions ~~encoded with data for instructing the~~ that, when executed by a processor, causes the processor to perform error diffusion halftoning, the error diffusion halftoning including performing quantization, and filtering with an effective bandpass characteristic without using an output of the quantization to directly influence an input of the quantization.

Claim 16 (currently amended): The machine-readable memory ~~article~~ of claim 15, wherein the processor-readable instructions cause the processor to perform operations comprising using the filtered error signal ~~is used~~ to modify the quantization input.

Claim 17 (currently amended): The machine-readable memory ~~article~~ of claim 15, wherein the filtering is based on the noise transfer function

$$B(z) = \frac{(1-\alpha)H(z) + \alpha H(z)K(z)}{1 - \alpha H(z) + \alpha H(z)K(z)}$$

where H(z) and K(z) are transfer functions; and α is a scalar that controls pixel clustering.

Claim 18 (currently amended): The machine-readable memory ~~article~~ of claim 17, wherein coefficients of the transfer functions H(z) and K(z) sum to unity at dc.

Claim 19 (currently amended): The machine-readable memory ~~article~~ of claim 15, wherein the processor-readable instructions cause the processor to perform operations comprising: ~~using the filtering includes~~ low pass filtering the quantization output with a first linear weighting filter;~~,~~ generating an error signal from the filtered output signal and the quantization input, and low pass filtering the error signal with a second linear weighting filter.

Claim 20 (currently amended): The machine-readable memory ~~article~~ of claim 15, wherein the processor-readable instructions cause the processor to perform operations comprising: ~~the filtering includes~~ generating an error from the quantization input and output; and applying an infinite impulse response filter to the error signal, an output of the infinite impulse response filter used to modify the quantization input.

Claim 21 (original): A printer comprising:

a print engine; and

a processor for performing error diffusion halftoning, the halftoning including performing quantization, and using an error signal filtered with an effective bandpass characteristic to influence the quantization without using a result of the quantization to directly influence an input of the quantization, an output of the quantization supplied to the print engine.

Claim 22 (currently amended): The method of claim 1, wherein:

the processing comprises

modifying the output to produce a modified output, wherein the modifying of the output comprises filtering past errors in accordance with a first low-pass filter transfer function and incorporating into the modified output the past errors filtered in accordance with the first low-pass filter transfer function, and

subtracting the modified input from the modified output to produce a second error value

filtering the second error value in accordance with a second low-pass filter transfer function to produce the first error value; and

the modifying comprises incorporating into the current input past error values filtered in accordance with the second low-pass filter transfer function to produce the modified input.

Claim 23 (previously presented): The method of claim 1, wherein

the modifying comprises incorporating into the current input the past quantization errors filtered in accordance with a bandpass filter transfer function to produce the modified input, and subtracting the modified input from the output to produce the error value.

Claim 24 (currently amended): The ~~article~~ machine-readable medium of claim 15, wherein the ~~article~~ machine-readable medium stores processor-readable instructions causing the processor to perform operations comprising:

modifying a current input to produce a modified input, wherein the modifying comprises incorporating past quantization errors into the current input;

quantizing the modified input to produce an output; and

processing the output through a data processing path having a bandpass transfer characteristic, wherein the processing comprises deriving an error value from the modified input and the output and diffusing the error value into future inputs.

Claim 25 (previously presented): The printer of claim 21, wherein the processor is operable to perform operations comprising:

modifying a current input to produce a modified input, wherein the modifying comprises incorporating past quantization errors into the current input;

quantizing the modified input to produce an output; and

processing the output through a data processing path having a bandpass transfer characteristic, wherein the processing comprises deriving an error value from the modified input and the output and diffusing the error value into future inputs.